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70-358 AU 358 48509
(SE 8500407) GB 2154652
(AUG 1985) SEP 1985

(12) UK Patent Application (19) GB (11) 2 154 652 A

(43) Application published 11 Sep 1985

(21) Application No 8503650

(22) Date of filing 13 Feb 1985

(30) Priority data
(31) 829/84 (32) 21 Feb 1984 (33) CH

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(51) INT CL⁴
E05B 27/06 27/10

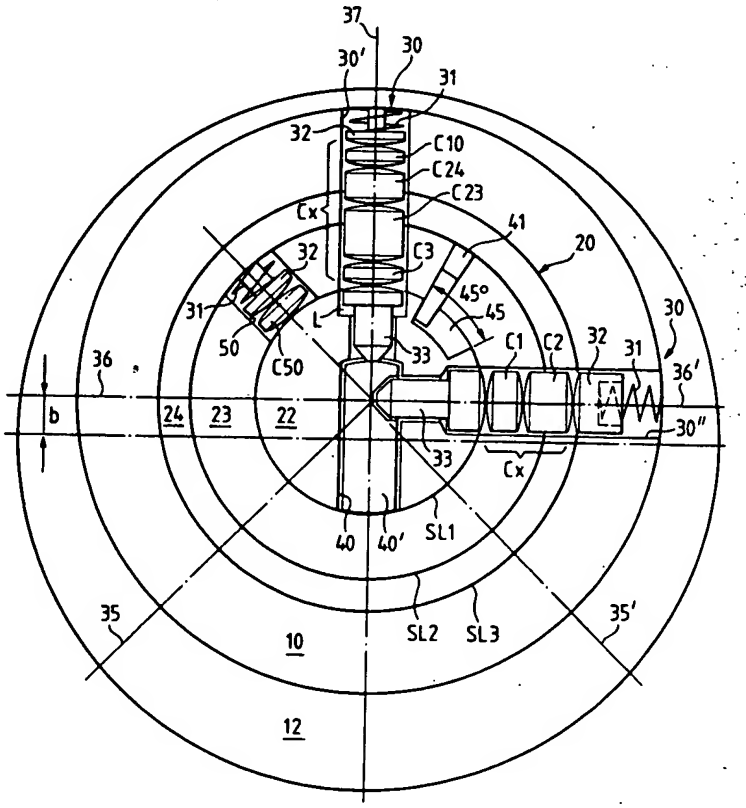
(52) Domestic classification
E2A 155 157 LT

(56) Documents cited
GB 1590090 GB 0396914

(58) Field of search
E2A

(54) Lock cylinder

(57) A lock cylinder has at least one additional shearing line (SL2) formed by the rotor (22) and by a rotor course (23) arranged concentrically round the rotor (22) and having radial tumbler bores (30', 30''), and the tumbler pins (33) are extended by coding discs (Cx) not connected fixedly to them. In a further design, the rotor course (23) has an additional radial bore (50) for receiving at least one coding disc (C50). The rotor (22) has a recess (45) in the form of a hollow cylinder sector and the rotor course (23) has a detent pin (41) directed radially towards its centre, the rotor (22) and rotor course (23) being arranged relative to one another in such a way that the detent pin (41) projects into the recess (45). To form a third shearing line (SL3), there is a second rotor course (24) which is arranged above the first rotor course (23) and concentrically relative to the latter and to the rotor (22) and which has radial tumbler bores (30', 30'').



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SPECIFICATION

Lock cylinder

The invention relates to a lock cylinder for, or of, a cylinder lock.

As regards lock cylinders in widespread use today and considered de facto as standard, there are many security-related problems which have not yet been solved or have been solved only inadequately. One is the problem of pass keys and another the problem of key copying. In certain sectors of use, these two problems are simultaneously and closely interrelated. This arises wherever relatively many users or key owners are brought together in fairly large key heirarchies. Such lock-cylinder/key hierarchies, because of their functional correlation, can be regarded as locking systems; this term is also used in this way among experts.

A locking system, of which the users, that is to say the key owners, are mainly always the same over a period of time, is found in apartment blocks, businesses, etc; key owners who change frequently or constantly are found in communal institutions, hotels and similar commerical units. Practically all these systems employ a hierarchical arrangement with keys for unrestricted access and keys for restricted access, and a particular security aspect stands out here where constantly changing, that is to say temporary, key owners are concerned. This is the loss of a key from the locking system. The higher the rank of the missing key, the more urgent and at the same time the more comprehensive become the measures to be taken to return to the previous situation. The most important measure is the exchange of the particular cyclinder locks; this is also the measure which is adopted most often by far.

According to the present invention, there is provided a lock cylinder comprising a rotor and stator; radial bores extending in these and aligned with one another in the opening position of the lock cylinder; tumbler pins inserted displaceably in the radial bores, there being at least one additional shearing line formed by the rotor; and a rotor course arranged concentrically around the rotor and having rdial tumbler bores; the tumbler pins being extended by coding discs not connected fixedly to them.

As will become apparent from the following description, the invention can provide a locking device which allows a conventional key hierarchy and which, when a key is lost from this hierarchy, makes it possible by means of as simple a measure as possible, without the need to remove or exchange the particular lock cylinder or cylinders, to return to the original degree of security within the hierarcy structure and to design the locking device so that it is suitable for turnkeys.

In an advantageous design, the rotor course has an additional radial bore for receiving at least one coding disc. In a further embodiment, the rotor has a recess in the form of a hollow cylinder sector and the rotor course has a detent pin directed radially towards its centre, the rotor and rotor course being arranged relative to one another in such a way that the detent pin projects into the recess.

A further embodiment has the feature that, to form a third shearing line, there is a second rotor course which is arranged above the first rotor course and concentrically relative to the latter and to the rotor and which has radial tumbler bores.

The invention is now described below with reference to the single drawing which sows a section through a lock cylinder designed according to the invention.

The drawing shows an example of a lock cylinder with a stator 10, a multi-course rotor 20, multi-membered tumblers 30 acting operatively on the stator and rotor, and a key channel 40 extending in the rotor. The hollow-cylindrical stator 10 is arranged in the eccentrically hollow stator sleeve 12 which has a circular periphery of a radius corresponding to the lock-cylinder standard. The stator 10 is arranged displaced eccentrically along the vertical axis of the key channel over a length b in relation to the centre of the circular stator sleeve periphery. The multi-course rotor 20 is inserted within the hollow-cylindrical stator 10. In this example, this multi-course rotor 20 consists of a rotor core 22 with the key channel 40, a hollow-cylindrical first rotor course 23 surrounding this rotor core 22, and a hollow-cylindrical second rotor course 24 surrounding the rotor core and the first rotor course. The core and rotor courses are arranged concentrically relative to one another.

A first shearing line SL1 is located between the rotor core 22 and the first rotor course 23; a second shearing line SL2 is located between the first rotor course 23 and the second rotor course 24; a third shearing line SL3 is located between the second rotor course 24 and the stator 10. The relative movements of the core, rotor courses and stator in relation to one another are controlled by the multi-membered tumblers 30.

Taking the key as a starting point, a multi-membered tumbler 30 generally consists of a tumbler pin 33 penetrating into the key depressions, at least one circular-cylindrical coding element Cx, where x is the code function, and a counter-tumbler 32 with a helical compression spring 31 acting on it. In the present Figure, only two tumblers out of a possible five typical of this design are shown for the sake of greater clarity, these being a key narrow-side tumbler in the tumbler plane 37 and a 90° tumbler in the tumbler plane 36'. A further tumbler palne 36 for a 90° tumbler

and two tumbler planes 35, 35' each for a 45° tumbler (which can of course also be omitted) for receiving a further three multi-membered tumblers are marked appropriately. Swiss Patent Specification 621,175 shows a non-reversible lock cylinder with 5 tumbler series in the same spatial arrangement as shown here in the Figure with only 2 tumblers.

In the rotor core there is also a recess 45 in the form of a sector of an annulus. The angle between the two limiting radii is approximately one eight of a revolution. A detent pin 41 fastened in the first rotor course 23 projects into the recess 40 and allows an appropriately restricted rotary movement along the first shearing line SL1 between the rotor core 22 and the first rotor course 23. Furthermore, in the first rotor course 23 there is a blind bore or at least a bore 50 closed off from the second shearing line SL2, for receiving a counter-tumbler 32, with a helical compression spring 31 acting on it, and for receiving a circular-cylindrical coding element C50. The two measures, namely the recess 45 with the detent pin 41, on the one hand, and the blind bore 50 with the counter-tumbler 32 under spring tension and with the coding element C50, on the other hand, serve for changing the locking code.

The multi-membered tumbler 30 shown in section and located in the tumbler plane 37 runs in a bore 30' of specific length. Taking as a starting point the key 40' inserted in the key channel 40, this multi-membered tumbler is composed as follows: a tumbler pin 33 penetrating into the particular key depression, above it a coding element C3, namely the coding element C50 taken out of the blind bore 50 and reproduced again here, above this a coding element C23 synchronised with the first rotor course 23, above it a coding element C24 synchronised with the second rotor course 24, above it a further coding element C10 arranged in the stator 10 and intended for pass-key coding, and finally above this a counter-tumbler 32 with a compression spring 31. The multi-membered tumbler 30 in the tumbler plane 36' is constructed in a similar way, namely with a tumbler pin 33, above it a first coding element C1 synchronised with the first rotor course and intended for normal locking, above this a second coding element C2 intended for separate pass-key locking, and above this, as the last member, the counter-tumbler 32 with the compression spring 31. This tumbler is likewise accommodated in a bore 30'' of specific length.

It can easily be seen in the Figure that the coding elements of the multi-membered tumblers block or release specific shearing lines depending on their position in the bore. This blocking/release of the shearing lines or rotor courses relative to one another is controlled by means of an appropriately drilled, that is to say coded key. Thus, individual shearing lines can be assigned to special locking functions, for example the shearing line SL1 between the rotor core 22 and the first rotor course 23 is released only by means of the drilling pattern of a change key for changing the locking code, the shearing line SL2 between the first rotor course 23 and the second rotor course 24 responds to the drilling pattern of a normal or individual key, and the shearing line SL3 between the second rotor course 24 and the stator 10 is activated only by the drilling pattern of a group key or pass key. This makes it possible, with only one key, to organise the locks in groups by means of appropirate drilling patterns, and in the event of the loss of an individual key to change over any of five tumblers in the lock cylinder or several of them, as desired. This does not then necessitate new keys for an entire locking group, since the codes of the group pass keys are not included when a tumbler is changed over. When there are 5 change tumblers in one cylinder lock, a cylinder can (theoretically) "cope" with 2 to the power of 5, that is to say 32 individual key losses, without having to be replaced.

The bore 30' of the tumbler plane 37 is of such a length that the tumbler pin 31 can penetrate into the rotor core 22 until the coding element C50 is accommodated in the rotor core 22 and can be pushed to and fro between the blind bore 50 and the tumbler bore 30'. This length depends on the drilling depth of the stepped bore L in the rotor core 22. The penetration of the coding element C50 is produced by means of a change key having the appropriate drilling pattern for change-over. At the same time, the rotation between the two bores in order to exchange a coding element is limited by the detent pin 41 projecting into the recess 45 and fixed in the first rotor course 23. In the Figure shown, the lock cylinder is in the change-over position; only the first shearing line between the rotor core 22 and the first rotor course 23 is released, the other shearing lines being blocked, that is to say a change key with its specific drilling pattern is inserted in the key channel 40. It is necessary to ensure, here, that each tumbler series can participate in the drilling pattern for the change key, this being the case as regards the 90° tumbler in the drawing. This increases locking security enormously, since, for example, the change key cannot be distinguished directly from a normal key or a pass key or group key. Consequently, the finder of a key does not known which type he has found, and as a result of the loss of just this particular key, with efficient organisation the lock cylinder has already been changed over and new keys matching the changed drilling pattern made. This also acts as a safety measure against unauthorised

copying of a key which, for example, has been "found again".

When a normal key brings, for example, the key narrow-side tumbler 30 of the tumbler plane 37, as a result of displacement in the direction of the spring force, into a position in which the second shearing line SL2 is no longer blocked between the coding elements C23 and C24, and at the same time displaces the position of the tumbler 30 of the tumbler plane 36', according to the Figure this being a displacement against the spring force, until the second shearing line SL2 is released, then it is possible for the rotor core 22, together with the first rotor course 23, to rotate freely, thereby opening the lock cylinder. It must be remembered, again, that all the tumbler series can be included again in the drilling pattern of a normal key. According to the Figure illustrated, a group key or pass key would have a drilling pattern which would leave the tumbler 30 of the tumbler plane 36' in the position shown, but would displace the tumbler of the tumbler plane 37 in the direction of the spring force, that is to say in the direction of penetration into a key bore, until the third shearing line SL3 between the second rotor course 24 and the stator 10 is released completely. At the same time, in the resulting free rotation, the rotor core 22, the first rotor course 23 and the second rotor course 24, which are of course interlocked, are simultaneously rotated through the angle which opens the lock cylinder.

When, to change the locking code, the coding element C50 of the multi-membered tumbler 30 in the tumbler plane 37 is advanced as a result of the above-described displacement by means of a change key, then a "new" tumbler is obtained, and this renders ineffective all the particular keys which activate this tumbler. Where such a key is concerned, at least as regards this tumbler all the coding elements are in the wrong positions and consequently lock the shearing lines; free rotation to open the lock cylinder becomes impossible.

It should not be overlooked, here, that, in a cylinder lock, further tumblers in planes "lined up" axially relative to the main axis of the cylinder, that is to say radial planes with tumblers, participate in this operation at the same time. Normally, 5 tumbler sections are provided; 5 blind bores 50, each with one or more coding elements C50, can be accommodated in such a section. Furthermore, each tumbler section can have up to 5 radial tumbler planes, each with a tumbler, a key narrow-side tumbler and two 90° tumblers and two 45° tumblers. For the purpose of transport of the coding elements, the blind bore must lie in one of the tumbler planes, in order to be aligned with the tumbler bore of this tumbler in the radial direction; in the Figure, this is the tumbler plane 37. As already mentioned, when there are 5 change-over bores, each with the coding element 32, different change-overs can be made until the lock cylinder finally has to be replaced. In actual fact, there are more than this, since after the 32nd change-over one of the previous settings, for example the first setting, can be used again, even whilst at the same time taking into account the security aspect. It must then also be mentioned, with regard to the unusual flexibility of the solution according to the invention, that the change-over is of course not restricted to the tumbler plane 37, but can be made without problems in any other plane.

CLAIMS

1. A lock cylinder comprising a rotor and stator; radial bores extending in these and aligned with one another in the opening position of the lock cylinder; tumbler pins inserted displaceably in the radial bores, there being at least one additional shearing line formed by the rotor; and a rotor course arranged concentrically around the rotor and having radial tumbler bores; the tumbler pins being extended by coding discs not connected fixedly to them.

2. A lock cylinder according to claim 1, wherein the rotor course has an additional radial bore for receiving at least one coding disc.

3. A lock cylinder according to claim 1 or 2, wherein the rotor has a recess in the form of a hollow cylinder sector and the rotor course has a detent pin directed radially towards its centre, the rotor and rotor course being arranged relative to one another in such a way that the detent pin projects into the recess.

4. A lock cylinder according to any one of claims 1 to 3, wherein to form a third shearing line, there is a second rotor course which is arranged above the first rotor course and concentrically relative to the latter and to the rotor and which has radial tumbler bores.

5. A lock cylinder constructed and arranged to operate substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

Printed in the United Kingdom for
Her Majesty's Stationery Office, Dd 8818935, 1985, 4235.
Published at The Patent Office, 25 Southampton Buildings,
London, WC2A 1AY, from which copies may be obtained.

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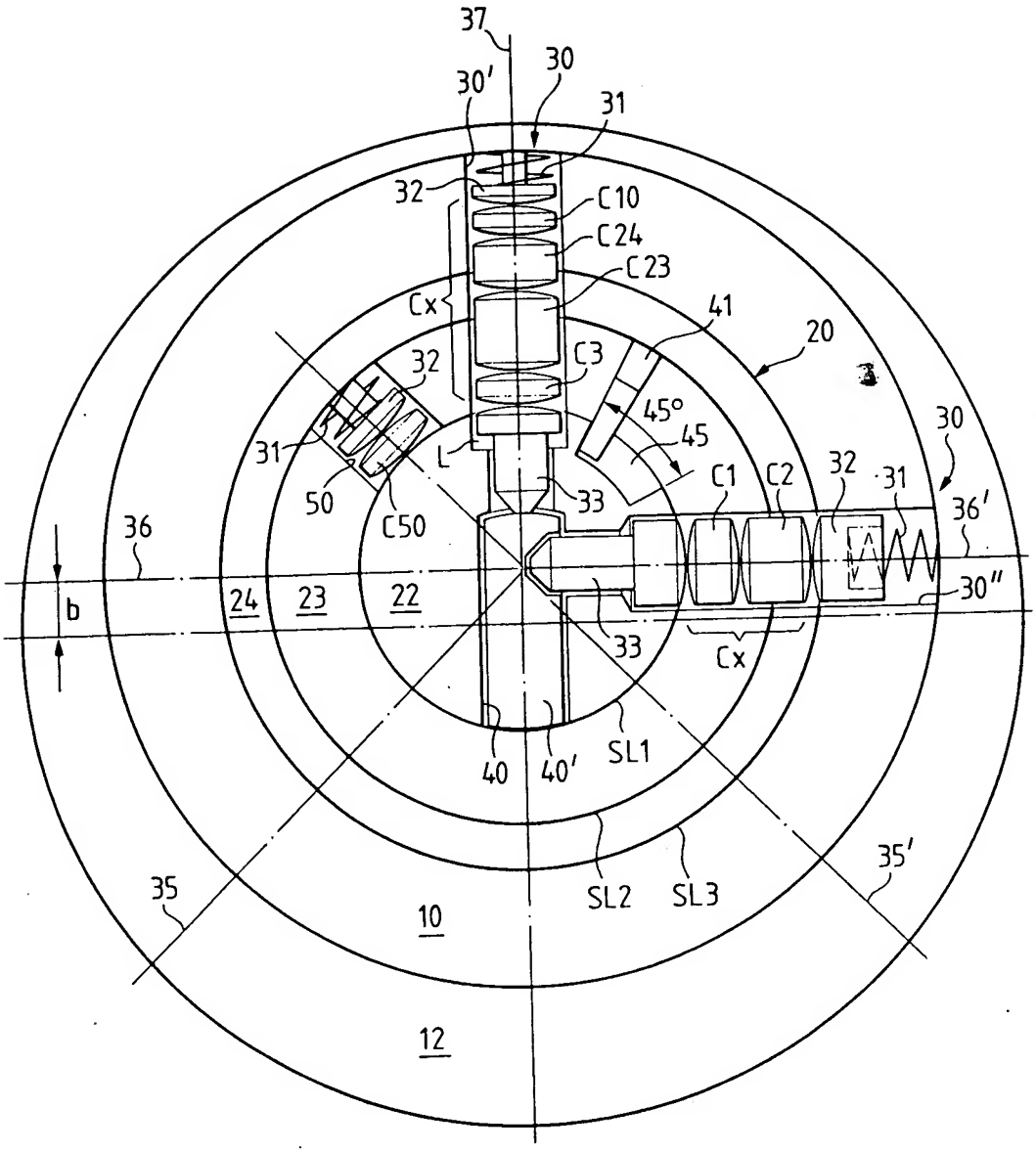
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